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## ORIGINAL ARTICLE

# A well-fixed femoral stem facing a failed acetabular component: To exchange or not? A 5- to 15-year follow-up study

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Accepted: 17 August 2011

### KEYWORDS

Acetabular;  
Revision;  
Arthroplasty;  
Morbidity;  
Hip

### Summary

**Introduction:** There is no consensus about the necessity of exchanging a stable femoral component during revision total hip arthroplasty (RTHA) when only the acetabular component requires replacement. Sparing the femoral component reduces morbidity, but can make acetabular replacement technically more difficult. Moreover, the outcome of the retained femoral component is also a question, especially with older implants.

**Hypothesis:** Isolated acetabular component RTHA results in lower surgical morbidity, and does not increase the risk of later femoral complications.

**Patients and methods:** Eighty-nine patients, mean age 68, underwent surgery (anterior approach on traction table) for isolated acetabular component revision between 1994 and 2005. The femoral component had been implanted a mean 10.5 years before revision.

**Results:** Fifteen patients died, mean age 84.5. Eleven patients, mean age 81.3, were lost to follow-up and four underwent revision due to a subsequent infection (range 14 months – 11 years). Fifty-nine patients were evaluated after a mean 8.6 years (range 4 – 15 years). At follow-up the mean Harris score was 89.2 [IC = 6.89; 44 – 100] and the mean Merle d'Aubigné score was 15.3 [IC = 1.57; 11 – 18]. Five patients (5.6%) underwent surgery again due to postoperative dislocation. Six patients underwent surgery for recurrent acetabular loosening due to allograft resorption. The size of the bone defects did not increase the risk of these failures ( $P > 0.6$ ). Fractures occurred in two femoral components 6 and 9 years after revision. Polyethylene wear occurred in three patients requiring two repeat revisions at 6 and 7 years. In both cases the femoral component included a titanium head, which caused the wear. Implant survival at 8.6 years was  $85.16 \pm 0.117\%$  all causes of revision combined,  $88.47 \pm 0.113\%$  if infectious causes were excluded and  $93.6 \pm 0.07\%$  if only cases of acetabular component failure were taken into account.

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**Conclusion:** Intermediate term outcomes are satisfactory if stable femoral components are retained. Nevertheless, this procedure should be performed in situations of correctly oriented modular components. In single piece (monoblock) femoral implants, or in implants with a history of failure, this technique should be restricted to elderly and/or fragile patients.

**Level of evidence:** Level IV, Retrospective study.

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## Introduction

Although loosening is the most frequent complication in total hip arthroplasties, acetabular and femoral components are not affected in the same way. Although femoral loosening progresses linearly, that of the acetabular component increases exponentially after 10 years [1]. In case of revision due to failure of the acetabular component alone, one option is to change both components based on the theory that both are worn, while another is to limit revision to the acetabular component, because changing the femoral implant increases the morbidity of this procedure. For example Poon et al. [2] observed that surgery was one third less long, and there was 50% less bleeding in case of isolated acetabular component revision. This procedure avoids femoral complications such as fractures and misalignment whose rates range from 6.3–21% [3–6]. On the other hand, preserving the femoral component can make access to the acetabulum and treatment of bone defects more difficult, or even impede insertion of the acetabular component, increasing the risk of postoperative dislocation [7]. Finally, the problem of the mechanical future in the already worn femoral component, or in the case of monoblock femoral implants, the risk of premature wear of the acetabular implant from a deformed or scratched head, remains [8]. To attempt to respond to these questions, we present the intermediate term results of a series of isolated acetabular component revisions, paying special attention to the quality of acetabular reconstructions obtained, and evaluating the complications, especially dislocations.

## Patients and methods

### Patients

Eighty-nine patients (89 hips) were operated on for isolated acetabular component revision between January 1994 and September 2005. This included 25 men and 64 women, mean age 68 (range 33–89). In most cases (78) the indication for revision was isolated acetabular loosening. Eight patients underwent surgery for recurrent dislocations and three for ceramic-zirconia head fracture. Patients had undergone a mean 1.6 interventions before revision surgery (range 1–4). Femoral components had to be stable, with no areas of progressive osteolysis, and with a femoral anteversion [9] of between 5–35° on CT Scan. They were always left in place and none of the stems was temporarily removed. Monoblock components were carefully protected during the procedure, and were only preserved after clinical confirmation of the head surface. First generation uncemented femoral implants were preserved because they are difficult to remove. The

preserved femoral component was cemented in 74 cases and uncemented in 15. It was monoblock in eight cases (Table 1). The femoral component had been implanted for a mean 10.5 years (range 6 months–19 years) before revision. Evaluation of acetabular bone defects was based on SOFCOT criteria [10] and showed that 16 patients presented with stage I bone defects, 33 with stage II, 28 with stage III and 12 with stage IV (Table 2).

### Methods

Surgery was always performed by anterior approach on an orthopedic traction table. After the largest capsulectomy possible, the prosthesis was dislocated forward and the head was removed when the implant was modular. Once the orthopedic table traction was released the femur was pushed back with a retractor. An acetabular component, cemented with Palacos GR® bone cement in which

**Table 1** Preserved femoral components.

Preserved femoral component	Total series (89 patients)	Series at final follow-up (59 patients)
<i>Cemented</i>	74	39
Lagrange-Letournel™	33	16
Sapia™	28	18
Muller™ monobloc	4	1
Type Charnley	4	1
Others	5	3
<i>Uncemented</i>	15	10
Judet™ Porometal	5	3
Lord™ Madreporic	2	1
Madreporic	3	3
Raymond Roy		
Camille™		
Corail™	3	2
Zweymuller™	2	1

**Table 2** Stage of acetabular bone defects according to the SOFCOT classification [10].

SOFCOT stage	Total series (89 patients)	Series at final follow-up (59 patients)
Stage I	16	11
Stage II	33	24
Stage III	28	20
Stage IV	12	4

gentamicin was added, was used in all cases. This was a standard component in 81 cases and a component with a retaining system in eight patients who underwent surgery for recurrent dislocations. The diameter of the femoral head component was 22.2 mm in 13 cases, 26 mm in 23, 28 mm in 47 and 32 mm in six. Stainless steel heads were always used except in two cases in which the type of preserved component required the use of a titanium Adamante™ coated femoral head (La Biomécanique Intégrée, Brétigny-sur-Orge, France).

Simple cementing was performed in case of stage I acetabular defects (16 cases) and reconstruction with cryo-preserved allografts was performed and reinforced in all cases by a Kerboul acetabular reinforcement device (73 cases). Femoral bone lesions were left as is or simply curetted. All patients received antibiotic prophylaxis with first generation cephalosporin. In case of allergy an association of clindamycin and gentamicin was used. Thromboembolic prophylaxis was provided by low molecular weight heparin. Except for the cases of simple cementing, full weight-bearing was only allowed after 6 weeks. Patients were followed-up 45 days after full weight bearing, then at 3 and 6 months at 1 year and at 2 years.

## Method of evaluation

Clinical results were evaluated by the Merle d'Aubigné [11] and Harris [12] scores. AP view X-rays of the pelvis and AP and profile views of the operated hip were evaluated to identify periacetabular radiolucencies based on DeLee and Charnley's criteria [13] and perifemoral radiolucencies according to Gruen et al. [14].

## Statistical methods

Values were analyzed using Sigmasat™ software (LogiLabo, Paris, France). Comparison of the two populations was performed with the Chi<sup>2</sup> test, by applying the Fisher's exact test for small groups.  $P < 0.05$  was considered to be statistically significant. Survival was evaluated according to the Kaplan Meier, whatever the cause of revision, then infectious causes were excluded, then an analysis was made limited to revisions for mechanical reasons, and finally including only repeat acetabular revisions.

## Results

### Complications

Fifteen (16.8%) of the 89 patients who were treated had early ( $n=11$ ) or late ( $n=4$ ) complications. Eleven patients (12.4%) presented with 15 complications (16.9%). One patient had a transitory postoperative stroke. Two hematomas were surgically treated. One patient had incomplete sciatica palsy and had recovered at 16 months of follow-up. Five patients (5.6%) presented with postoperative dislocation; four patients, all with 28 mm diameter femoral heads, were treated by simple reduction. Dislocation was surgically reduced in one patient, with a 22.2 mm femoral head, due to recurrent dislocation. The diameter

of the femoral head did not influence dislocations in our series ( $P=0.6$ ). Four patients presented with deep venous thrombosis which resolved with appropriate treatment and two with a urinary tract infection. Four patients had late complications: four patients (4.5%) were treated for deep infection, which developed a mean 8 years after surgery (range 14 months – 11 years). Two of these patients were treated in the unit and were doing well at the last follow-up. Two were seen elsewhere, one consulted once with a favorable outcome, the other is undergoing a femoral head-neck resection.

## Outcome of the population

Twenty-six patients were lost to follow-up ( $n=11$ ) or died ( $n=15$ ). Their files were included to evaluate survival. Fifteen patients, mean age 84.5 (range 45–94) died a mean 4.2 years (range 2 months – 10 years) after, but not due to, surgery. Eleven patients, mean age 81.3, (range 59–90) were lost to follow-up a mean 4.2 years after surgery (range 2–7).

A total of 59 patients who underwent isolated acetabular revision had clinical and radiological evaluation after a mean follow-up of 8.6 years (range 4–15).

## Surgical revisions and functional results

Besides the four late infections, 11 patients underwent repeat surgical revision. One patient underwent complete revision due to recurrent dislocation as mentioned above. Two patients in whom a titanium Adamante™ coated femoral head was used, presented with significant wear after 6 and 7 years respectively, requiring bipolar revision. Six patients underwent surgery due to recurrent acetabular loosening due to allograft resorption, a mean 7.1 years (range 23 months–15 years) after the initial revision. During the initial revision, bone defects were stage II in two cases, stage III in three cases and stage IV in one case. The size of the defect did not have a statistically significant affect on the need for repeated revision ( $P > 0.6$ ). Two uncemented implants fractured at 6 and 9 years and recurrent revision was performed (Fig. 1). These were first generation prostheses – madreporic in one case and poro-metal in the other – implanted 14 and 19 years earlier respectively, which had not been removed due to the difficulty of extraction.

Forty-eight patients did not undergo additional surgery (Fig. 2a and b). At the final follow-up, the mean Harris score was 89.2 [IC = 6.89; range 44–100] and the mean Merle d'Aubigné score was 15.3 [IC = 1.575; range 11–18]. The total expected survival of implants at 8.6 years, all types of revision combined, was  $85.16\% \pm 0.11$ ,  $88.47\% \pm 0.11$  when revisions due to infection were excluded and  $93.6\% \pm 0.07$  if only revisions due to acetabular failure were included.

## Radiological results

Two patients aged 86 and 87 years old presented with complete periprosthetic radiolucence and 5 mm of migration clearly indicating femoral component loosening, 7 and 13 years after revision respectively. Because of the age of the



**Figure 1** Lord's madreporic prosthesis implanted 17 years before isolated revision acetabular replacement.

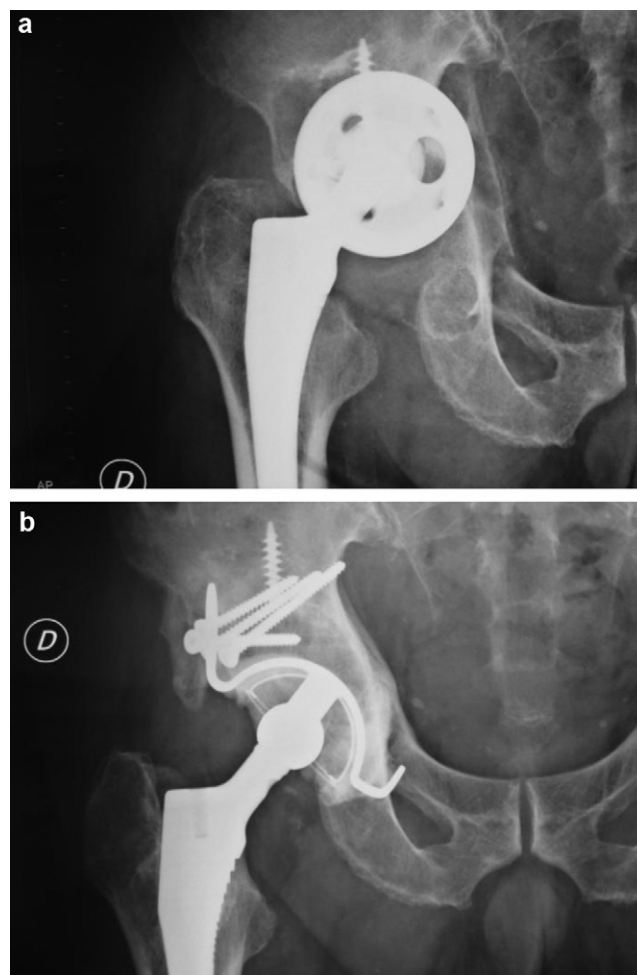
patients and associated co-morbidities as well as relatively good tolerance to loosening, surgery has not been performed for the moment. If revisions due to femoral component fracture, and patients with confirmed loosening in whom revision was not performed are taken into account, the risk of revision is not higher between cemented and uncemented femoral components ( $P=0.2$ ).

Three patients presented with radiolucence in Gruen's zone 1 and 7, associated in one case with resorption of the calcar. These lesions have remained stable over time. One patient presented with progressive osteolysis of the calcar associated with polyethylene liner wear of more than 5 mm. The preserved implant was monoblock with a 32 mm head.

At the final follow-up none of the acetabular components had migrated. There was complete radiolucence in three cups of less than 1 mm in two cases and between 1 and 3 mm in another. Fourteen components presented with partial radiolucence of between 1 and 3 mm in zone 3 in two cases and less than 1 mm in 12. There was bone incorporation in 29 of the allograft patients. In 11 cases a radiological line was visible between donor and recipient bone. In the first year after surgery, five patients presented with breakage of one of the screws to attach the reinforcement device that has not progressed since.

## Discussion

Isolated acetabular component revision represents 22% of our cases, which is similar to the rates in the literature [1,15–19]. This fairly high rate is a sign of the surgeon's desire to reduce morbidity in a procedure, which is often performed in elderly patients and in which extraction of the stable femoral component can be difficult. In our experience, complications were fairly frequent, and although they were minor in 40% of cases, they had to be revised surgically or otherwise in a similar number of cases. Nevertheless,



**Figure 2** Revision of acetabular loosening in an uncemented implant. a: 69-year-old patient with acetabular loosening associated with a stage IV bone defect; b: results at 7 years with graft incorporation and good clinical results (PMA = 16). A 6 mm of uncompensated radiological lengthening.

these rates are lower than those found after bipolar revisions [3,4,6,17].

Although dislocation is one of the most frequent complications with this type of surgery, and may require revision in up to 8% of cases [20–23], this rate is lower than that observed after bipolar revision [24]. There are numerous, interconnected factors influencing the development of this complication. The highest rates are found after isolated insert exchange of the polyethylene liner [25] and Bidar et al. [23] recommend confirming the metal-back orientation and the femoral component on CT-scan before performing this procedure, as well as confirming the absence of any intra-operative instability. This preoperative evaluation was systematically performed and was considered essential to limit postoperative instability, even if we used a surgical approach that is known to result in a low rate of dislocation [26,27]. Indeed, the influence of the surgical approach on the frequency of dislocations after isolated acetabular revision is difficult to analyze, because series are rarely comparable for study populations and the diameters of the femoral heads used. In a retrospective



single surgeon study, Park et al. [25] showed that dislocation was more frequent with a posterolateral approach than with an anterolateral approach. On the other hand for Manning et al. [19], when elements on the posterior plane can be reconstructed, the posterolateral approach may be better because dislocation does not occur. Unfortunately this type of reconstruction is not always possible and the results of this series should be interpreted with caution, because of the small number of cases and because the diameter of the femoral heads used for revision was 32 mm in more than three quarters of the cases. For Kim et al. [28] and Lawless et al. [29] this latter point plays a central role in post-revision implant stability.

Preserving the femoral component can make acetabular access difficult [17], even if the femoral head is removed in the case of modular components. In our practice excision of the entire neocapsule made it possible to push the femoral component behind the posterior column and obtain acetabular access that was acceptable for the surgeon. This made it possible to systematically reconstruct bone defects that were SOFCOT stage II or higher by associating a support device providing high quality fixation and immediate stability. For our team, as for others, [21,29–31], this reconstruction procedure seemed indispensable to obtain satisfactory intermediate term results. We feel that preserving the femoral component did not complicate reconstruction because implant survival at a mean 8.6 years of follow-up was 93.6% in our study, which is comparable to that in bipolar revisions [32–36]. Moreover, like Lawless et al. [29], in our failures due to allograft resorption, the size of initial bone defects whose reconstruction could have been complicated by the preservation of the femoral component, did not seem to influence the development of recurrent loosening. Unfortunately one case of partial sciatica paralysis occurred which may have been caused by our technique. Forward displacement of the femur during the posterior approach seems to be less iatrogenic [37]. Nevertheless, we continue to use the anterior approach for this type of surgery, which provides satisfactory access to the acetabulum, although we recommend being especially careful during the manoeuvres to expose it.

The preserved femoral component failed in 6% of the cases, which is comparable to the rate found in the literature [2,38,39]. Nevertheless, it must be mentioned that these cases occurred in first generation femoral stems and that the use of modern stems should reduce the number of these accidents. Besides failures of preserved components, we must also mention those associated with the head, which had to be used due to the preserved component. Indeed, in two cases, ion surface coated titanium femoral heads [40,41] were used resulting in significant and premature wear of the polyethylene liner and requiring early revision.

Only one case of progressive osteolysis developed associated with significant wear of the acetabular polyethylene liner. This developed in a patient with a monoblock femoral implant. Although the sample population is too small to draw conclusions, the results of large study of Grosjean et al. [7] should be remembered which showed that only 10% of the surfaces of explanted heads still had the necessary roughness and a spherical form corresponding to the manufacturer's specifications. A simple visual perioperative evaluation does not seem to be enough to confirm head

quality and Kim et al. [28] recommend changing monoblock implants, because in their experience the frequency of osteolysis was too high.

Series of isolated acetabular component revisions are fairly rare in the literature and usually retrospective. They include a limited number of patients with different types of femoral components making comparison difficult. Moreover, the number of lost to follow-up or deceased patients is high so that the statistical results must be interpreted with caution. Although our series has these same limitations, because of the homogeneity of our technique and the relatively long mean follow-up, these results, in particular on survival of preserved femoral components and acetabular reconstructions, are of interest.

## Conclusion

Our experience confirms the interest of preserving the femoral component in cases of revision due to acetabular loosening. By reducing the duration of surgery this technique reduces surgical morbidity in particular in elderly patients. Moreover, preservation of the femoral component does not affect the quality of acetabular reconstruction or increase the risk of dislocation as long as anteversion is evaluated preoperatively and is within acceptable limits. If anteversion is not acceptable and if the femoral component is monoblock, or is known to have a tendency to fracture, we perform bipolar changes, if need be cementing the femoral component in the cement sheath if this is still intact [39].

## Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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